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Mr. Dawes (*Monthly Notices R.A.S.* xx. 56) gives an observation of dark lines seen by him on the solar surface. He says: "During the most tranquil moments I satisfactorily made out an excessively narrow *black* line, a little broken in two or three places, as if by irregularities in the inner bright streak." But Dawes' observation was interrupted by a storm of hail, snow, and sleet.

In conclusion, it may be worth mentioning that the Sun-spot roughly indicated in the sketches, and called in a previous quotation "the rearward spot," also attracted notice here on the afternoon of September 15. In intervals of good seeing it was a beautiful object; the most striking feature being its many concentric, and apparently shelving, penumbræ, presenting some very fine detail.

Radcliffe Observatory, Oxford:
1899 January 9.

Note on a Preliminary and Unsuccessful Attempt to Photograph the Corona without an Eclipse. By Rev. C. D. P. Davies, M.A.

Before attempting a spectroscopic plan which I have had in mind with a view to investigate the corona without a total eclipse, it struck me that it might be just worth while to try something much simpler, unpromising though the prospect might be. I have tried it with results which I regard as negative, but which, nevertheless, it may be well to record, if only on the chance of saving others future trouble and disappointment.

In a photograph taken by Mrs. Maunder, after the end of totality in India last January, the whole outline of the Moon was induced to impress its image on the plate in spite of the intrusion of light from the photosphere into the camera. It occurred to me as being just within the bounds of possibility that traces of the corona might be obtained if light direct from the photosphere were prevented from falling on the lens producing the image on the plate. It would thus not enter the camera at all. I am not aware that this has been tried before. It is not quite the same thing as the employment of a screen, bar, or other eclipsing device in an eye-piece.

The following is the arrangement that I adopted: In a wooden tube of square section and four inches internal diameter I placed (*a*) an achromatic object-glass (the "Webster") of two inches diameter and 28-inch focus. In the focus of this, and coincident with the Sun's image, I soldered at the intersection of two fine wires set at right angles to each other (*b*) a brass circular disc of such size as just to cut out the image of the photosphere. The disc and wires supporting it could be rotated so that the image of the wires on the plate might serve as marks of the cardinal points of the Sun's periphery, or of his

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axis and equator, or for indicating any other desired positions. Besides being in the principal focus of the Webster, the brass disc was also in one of the conjugate foci of (*c*), another achromatic object glass (the Cox), the diameter of which is 1·4 inch, the principal focal length being 14·5 inches. It was placed 30·5 inches behind the disc, the dark slide (*d*) with photographic plate being in the other conjugate focus at a distance of 27·5 inches behind the Cox lens. The instrument was, in effect, two telescopes *tandem*, the hinder one looking at a total eclipse of the Sun in the focus of the foremost. The image of the Sun formed on the plate was of course direct. All stray light was carefully excluded.

FIG. 1.

With the exception of one exposure, No. 32, for which the Webster was stopped down to $\frac{7}{8}$ inch as an experiment, this lens was always employed with full aperture. The aperture of the Cox was continually being varied. Most of the earlier photographs were taken with full aperture, but as a rule subsequently it was stopped down either to $\frac{7}{8}$ inch or to $\frac{1}{4}$ inch. One object of these was to avoid a small fringe of outstanding colour arising from the fact that the focus employed was a conjugate and not the principal focus. The employment of either stop completely obviated this defect. Exposures of every conceivable duration were tried, some of the plates being exposed for so long that re-reversal took place. The times varied between the limits of half a second on the one side and, in the case of two exposures, as much as five minutes on the other. An exposure of above a minute yielded, as might have been expected, a negative of featureless blackness. On the whole the most promising plates were produced by exposures between ten seconds and a minute. When I say "promising," it is to be understood that I am referring solely to the hope of finding traces of corona, other portions of the plate being left to take their chance.

The position of the instrument in all the earlier attempts was such that the ends of the sides of the wooden tube of the instrument were parallel with the ends of the sides of the tube of the equatorial (also of square section) on which the instrument was mounted. Later on, when the sky continued clear for a sufficiently long interval, I made on two or three occasions three exposures in succession, of which the first was taken with the instrument in its normal position; the second, with it revolved entire on its line of collimation in one direction, and the third, in the opposite direction through an angle of 45° roughly. This

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was to prevent the presence of any features of instrumental origin on the plate from being mistaken for features of corona. These positions of the instrument will be easily understood from the figures

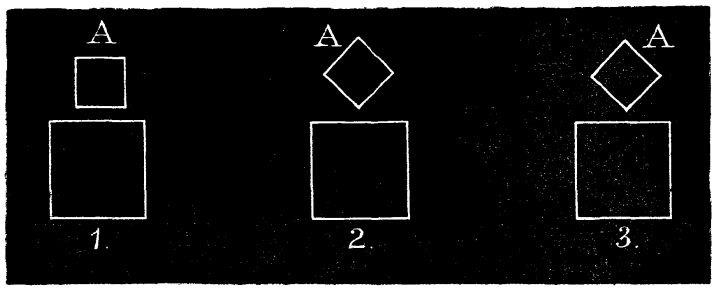

FIG. 2.

Here the lower squares represent the open end of the Newtonian equatorial, the upper ones that of the coronal instrument, A being the same side in each.

But though occasionally I fancied that distinct features could be detected on the negatives, I always had a sensation that others would never see them there, and that probably I saw them, or thought I saw them, because I wanted to see them. There is, however, one striking point about many of them, viz. that viewed from a distance of eight to ten feet they look exactly like a photograph of a total eclipse. This is especially true of some of the prints.

On the whole I think there can be little doubt that any likeness to true corona on the plates is produced, perhaps to a small extent by halation, but chiefly by sky glare. This last is no doubt the enemy that stands in the way between us and the corona. To cause a total eclipse in an instrument is comparatively easy, but to overcome the powerful reflections of the photosphere from every particle floating in miles and miles of atmosphere is quite another thing. The denser deposit in close proximity to the circumference of the image of the disc on some of the plates is, I think, to be ascribed to diffraction from the edge of the disc, of which there was some, though not much.

On the night of November 27 I gave an exposure of five minutes on the full Moon, with a view to discover how much apparent corona was due to sky glare. The Cox lens was for this purpose stopped down to $\frac{7}{8}$ inch to avoid any suspicion of colour fringe. Though from the prolonged exposure there is a slight close-fitting ring of halo round the image of the disc, there is a remarkable absence of anything of the kind at a greater distance, and a print of this plate viewed at a distance of eight or ten feet bears no resemblance whatever to a total eclipse, as I remarked was the case with some of the solar photographs.

A feature of most of the plates—it may be a feature of all negatives—having practically no previous experience, I cannot

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tell—is that they show, or appear to show, more detail when viewed by reflected than when seen by transmitted light. Held up to the window, one often sees nothing but a faint image of the disc surrounded by a nebulous region of neither light nor shadow; but when backed by a sheet of white paper, it is in some cases difficult to believe that there is not *some* trace of genuine corona. The same was often seen just as the image was first showing itself in the developer. For all I know, however, this may be a characteristic of all developments. The plates used throughout were Sandell Triple-coated, the developer adopted being methol.

In the following list of plates the numbers in the column "Position" refer to fig. 2, in which 1 is the normal position, 2 that in which the top of the instrument was rotated about 45° to the west, and 3 that in which it was rotated about 45° in the opposite direction. The column headed "Aperture" refers to that of the Cox lens.

No.	Date. 1898	G.M.T.	Position.	Aperture.	Exposure.	Remarks.
1	July 27	3·40	1	F.	2 sec.	
2	„ 30	0·30	1	F.	6 sec.	
3	„ 31	3·10	1	F.	10 sec.	Negative seemed to give a faint trace of corona.
4	Aug. 7	4·25	1	F.	15 sec.	One of the best, if one may say so of any.
5	„ 9	0·30	1	$\frac{7}{8}$	30 sec.	
6	„ 10	23·10	1	$\frac{7}{8}$	$\frac{1}{2}$ sec.	Spoilt in development.
7	„ 10	23·30	1	$\frac{7}{8}$	40 sec.	
8	„ 20	3·25	1	$\frac{1}{4}$	90 sec.	Instrument jarred in opening shutter.
9	„ 23		1	$\frac{1}{4}$	3 min.	Not entered till later. Hour forgotten.
10	Sept. 2	3·30	1	$\frac{1}{4}$	4 min.	No good.
11	„ 2	11·30	1	$\frac{1}{4}$	5 min.	The Moon. Spoilt owing to non-provision for proper motion in Dec.
12	„ 2	23·0	1	$\frac{1}{4}$	5 min.	Useless.
13	Oct. 11	23·30	1	$\frac{1}{4}$	5 min.	
14	„ 12	Noon	1	$\frac{1}{4}$	1 min.	Reversal taken place.
15	„ 23	22·15	1	$\frac{1}{4}$	5 sec.	Jarred at opening.
16	„ 23	22·30	1	$\frac{1}{4}$	5 sec.	
17	„ 29	20·30	2	$\frac{1}{4}$	5 sec.	
18	„ 29	21·0	3	$\frac{1}{4}$	5 sec.	
19	„ 29	22·15	1	$\frac{1}{4}$	5 sec.	Clear intervals very short.
20	Nov. 3	23·5	1	$\frac{1}{4}$	5 sec.	
21	„ 3	23·20	2	$\frac{1}{4}$	5 sec.	

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No.	Date.	G.M.T.	Position.	Aperture.	Exposure.	Remarks.
22	1898 Nov. 3	23·40	3	¼	5 sec.	Sky getting a little white.
23	„ 13	0·40	2	¼	10 sec.	Fogged owing to accident to shutter.
24	„ 13	1·0	2	¼	10 sec.	
25	„ 18	0·40	2	F.	15 sec.	Photosphere got exposed.
26	„ 18	1·0	3	F.	15 sec.	Spoilt.
27	„ 18	1·10	3	F.	15 sec.	Wind rising a little.
28	„ 21	22·45	1	F.	15 sec.	Slight shake at opening.
29	„ 21	23·8	2	F.	15 sec.	
30	„ 22	Noon	3	F.	15 sec.	
31	„ 27	10·25	1	⅞	5 min.	The full Moon. Excellent negative.
32	„ 29	23·50	1	¼	1 sec.	The Webster was also stopped to ⅞ inch.
33	1899. Jan. 4	23·45	1	¼	½ sec.	

Eclipse of the Moon, 1898 *December* 27. By Rev. Walter Sidgreaves, S.J.

The night of the 27th was on the whole remarkably favourable for the physical observations connected with the passage of the Earth's shadow across the Moon's disc. The sky showed a clearness of our atmosphere seldom excelled, but often observed on the break-up of storm clouds. Our attention, however, had been confined, from the beginning, to the accurate timing of the occultations and reappearances of small stars near and during totality. But incidentally the following notes of the appearance of the Moon were made. My own impressions, with unaided eye, were: 1. That the arc-margin of the shadow as it advanced on the Moon was solid and sharp. 2. That the shadow remained dark, without colour, until the silvery-white crescent vanished at totality. 3. That after totality the change of appearances might be likened to a colour-repetition of an earlier phase; in which the dark gibbous portion assumed the colour of a copper plate after cooling down from a bright red heat, and the remaining crescent glowed with a bright yellow, about the tint of the carbon film of an electric glow-lamp when not quite "full." 4. That the bright yellow cap, as was expected, disappeared at mid-totality, and reappeared on the side of approaching light with the approaching end of totality. 5. That the contrast brightness of the eclipsed limb at the early stages of partial eclipse was as marked as on the Earth-shine limb of a new Moon.

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